Chapter-3 | Unit-1 | Hospital and Clinical Pharmacy

Topic in these Notes

Supply Chain and Inventory Control

Unit-1

- Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics
- Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Unit-2

- Inventory control techniques: Economic Order Quantity, Reorder Quantity Level, Inventory Turnover etc.
- Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods.

Unit-3

- Expiry drug removal and their disposal methods e.g., Narcotics
- Documentation - purchase and inventory.

Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics.

Preparation of Drug lists

In most hospitals the reconstitution and preparation of complex drugs takes place in centralized units typically in a controlled environment with experienced staff.

When preparing intravenous drugs there are key elements that need to be taken into account:

- Accurate d se and concentration
- Sterility
- Stability
- Occupational exposure

High risk drugs:

- High risk drugs are medicines that can cause significant harm to the patient; they may cause serious side-effects especially when administered incorrectly or when a dose is calculated incorrectly.
- High risk drugs may also have a narrow therapeutic range; which means there is little difference between sub-therapeutic, therapeutic and toxic doses.

List of High risk drugs:

Drugs	Monitoring	Symptoms	Actions Required	Interactions
CARBAMAZEPINE	• Full blood count, • renal function, • liver function	• Leucopenia • Blurred vision, • Diplopia • Skin Disorders • Hepatic disorders • Antiepileptic • Hypersensitivity Syndrome	• Advise patient to report immediately to a doctor if any warning signs occur • Ensure the patient receives the same brand of medicine at each time of collecting a prescription and that the patient is aware of which brand they are maintained on • Ensure patient is aware of the law regarding seizures and driving • Inform the patient of potential interactions and the need to check with a pharmacist or doctor before taking any new medication (including OTC, prescribed or herbal medicines)	• Increased plasma concentration with acetazolamide, cimetidine, clarithromycin, erythromycin, fuoxetine, isoniazid. • Anticonvulsant effect antagonised by mefoquine, antipsychotics.
CICLOSPORIN	• Full blood count, • Liver function, • Serum electrolytes	• Neurotoxicity • Liver toxicity • Hypertension • Headache • Gingival hyperplasia	• Hypertension is a common side-effect of ciclosporin therapy. Advise patient to have their blood pressure monitored regularly	• Increased plasma concentration with clarithromycin, diltiazem, erythromycin, fuconazole, grapefruit juice, itraconazole,

	• Blood pressure		• Warn patients that they must not receive immunisation with live vaccines • Brand-specifc prescribing is recommended (if changing brand monitor closely for changes in ciclosporin level, serum creatinine and blood pressure) • Advise patient to avoid excessive exposure to UV light, including sunlight and to use a wide spectrum sunscreen (may reduce risk of secondary skin malignancies). Patients with atopic dermatitis and psoriasis should avoid use of UVB or PUVA • Advise patient to avoid a high potassium diet and grapefruit juice. • The oral solution formulations can be taken with orange or apple juices to improve taste	ketoconazole, miconazole, metoclopramide, verapamil, colchicine (with which concomitant use also increases risk of nephrotoxicity and myotoxicity) and tacrolimus (avoid) • Decreased plasma concentration with carbamazepine, orlistat, phenobarbital, phenytoin, rifampicin • Increased risk of hyperkalaemia when ciclosporin given with ACE inhibitors or angiotensin-II receptor antagonists, aldosterone antagonists • Increased risk of nephrotoxicity when ciclosporin given with NSAIDs and increased plasma concentration of diclofenac. • Increased risk of myopathy when ciclosporin given with atorvastatin, fuvastatin, pravastatin, rosuvastatin, simvastatin (avoid concomitant use)
CORTICOSTEROIDS	Blood pressure, blood lipids, serum potassium, body weight and height (in children and adolescents), bone mineral density, blood glucose, eye exam (for intraocular pressure, cataracts), signs	• Cough • Wheeze • Tight chest • Nausea • Vomiting • Weight loss • Fatigue • Headache • Muscular weakness	• Give the patient a steroid treatment card if long-term treatment is required. Explain that they must not stop treatment abruptly after prolonged treatment (> 3 weeks) • Check the patient is taking oral steroids in the morning as a single dose • Ensure that patients rinse their mouth or clean their teeth after	• Metabolism of corticosteroids accelerated by carbamazepine, phenobarbital, phenytoin and rifamycins. • High dose corticosteroid can impair immune response to vaccines; avoid concomitant use with live vaccines. • Hypokalaemia can be severe when given with other drugs that lower serum potassium e.g. loop

	of adrenal suppression		using inhaled corticosteroids • If the patient has not had chicken pox and measles in the past, advise them to avoid anyone with these infections	and thiazide diuretics. • Effects if antihypertensive and oral hypoglycemic drugs are antagonized by glucocorticoids.
GENTAMICIN AND AMIKACIN	• Renal function (nephrotoxicity), auditory and vestibular function (ototoxicity which is irreversible), serum-aminoglycoside concentration must be determined in the elderly, those with renal impairment, if high doses given, obesity and in cystic fbrosis	Hearing impairment or hearing disturbance	• Advise patient to report immediately to a doctor if any of the warning signs • Ensure patient is hydrated and drinking adequate amounts of fuid to prevent dehydration before starting treatment	• Increased risk of nephrotoxicity when aminoglycosides such as gentamicin are given with ciclosporin, tacrolimus, vancomycin • Increased risk of ototoxicity when aminoglycosides given with loop diuretics, vancomycin.
NSAIDs	• Progressive unintentional weight loss or diffculty swallowing • Pregnancy and breastfeeding • Swollen ankles or feet • Unexplained, persistent recent-onset dyspepsia • Worsening of asthma	• All patients of any age prescribed NSAIDs for osteoarthritis or rheumatoid arthritis or patients over 45 years who are prescribed NSAIDs for lower back pain should be co-prescribed gastroprotection (e.g. a proton pump inhibitor) • Recommend that oral NSAID is	----------	• Possible increased risk of convulsions when given with quinolones • Possible enhanced anticoagulant effect of coumarins and phenindione • Possible enhanced effects of sulfonylureas. • NSAIDs antagonise hypotensive effect of beta-blockers, calcium-channel blockers, ACEIinhibitors, angiotensin-II receptor antagonists, alpha-blockers, nitrates

		taken with or just after food • Inform patient of potential interactions, the need to check with a pharmacist or doctor before taking any new medication (especially OTC NSAIDs)		
PHENYTOIN	• Serum concentration , ECG and blood pressure with intravenous use, liver function, full blood count, serum folate, vitamin D. Phenytoin is highly protein bound; patients with impaired liver function, elderly or those who are gravely ill may show early signs of toxicity	• Fever • Sore throat, • Mouth ulcers • Leucopenia, • Aplastic anaemia, • Megaloblastic anaemia • Suicidal thoughts • Low vitamin d levels e.g. Rickets, osteomalacia	• Use caution when dispensing: Brand-specifc prescribing recommended as preparations containing phenytoin sodium (100mg) are equivalent to those containing phenytoin base (92mg). • The dose is the same for all phenytoin products when initiating therapy, but if switching between formulations, the difference in phenytoin content may be clinically signifcant	• Increased plasma concentrations with amiodarone, chloramphenicol, miconazole, topiramate, trimethoprim (also increased antifolate effect), metronidazole, clarithromycin, telithromycin (avoid during and 2 weeks after phenytoin) • Reduced plasma concentrations with rifamycins.

Emergency drugs:

- Emergency drugs are those drugs which may be required to meet the immediate therapeutic needs of patients and which are not available from any other authorized source in sufficient time to prevent risk or harm to patients.
- Emergency drugs must be available for use by authorized personnel at strategic locations throughout the hospital.
- Emergency drugs including, but not limited to: pharmacologic antagonists appropriate to the drugs used, vasopressors, corticosteroids, bronchodilators, antihistamines, antihypertensives and anticonvulsants.

List of Emergency drugs:

Drug	Indication	Dose	Quantity
Oxygen	Almost any emergency	100% inhalation	1 "E" cylinder with adjustable regulator (0-15L)
Epinephrine	Anaphylaxis Asthma unresponsive to albuterol/salbutamol	1: 1000 (1mg/ml), auto injector 0.3 mg/ml (EpiPen), 0.15 mg/ml (EpiPen Jr)	1:1000 mg/ml ampule, 1 EpiPen, 1 EpiPen Jr auto injectors
Nitroglycerin	Angina pain	0.4 mg sublingual every 3-5 minutes	1 metered spray bottle (0.4 mg)
Diphenhydramine	Allergic reactions	1 mg/kg IM/IV; max 50 mg *dosage by age)*	50 mg/ml vials and 1 box 25 mg tablets
Albuterol/salbutamol	Asthmatic bronchospasm	2 puffs; repeat as needed	Metered dose inhaler 2.5 mg/3ml nebulized solution
Aspirin	Myocardial infarction	81 mg chewable tablet	Chewable tablet, bottle baby aspirin

			(81 mg)
Glucose	Hypoglycemia (patient unconscious)	37.5 mg; repeat as needed	1 tube (37.5 mg)
Atropine	Clinically significant bradycardia	0.5 mg IV or IM	1 ampule (1 mg/10 ml)
Hydrocortisone	Adrenal insufficiency Recurrent anaphylaxis	100 mg IV or IM (mixed with 3-5ml sterile water)	1 vial (100 mg)
Morphine or nitrous oxide	Angina pain unresponsive to nitroglycerin	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation
Naloxone	Reversal of opioid overdose	0.1 mg/kg up to 2mg IV or IM	4 mg/10 ml multi-dose vial
Lorazepam or Midazolam	Status epilepticus	4 mg IM or IV 5 mg IM or IV	50 mg/10 ml multi-dose vial
Flumazenil	Benzodiazepine overdose	0.01 mg/kg at 1-minute intervals up to 1 mg IV or IM	0.5 mg / 5 ml multi-dose vial

Schedule H1 drugs:

- Schedule H1 has been introduced through to check the indiscriminate use of antibiotics, anti-TB and some other drugs in the country.
- The schedule contains certain 3rd and 4th generation antibiotics, certain habit forming drugs and anti-TB drugs.

SR. No.	Schedule H1 drugs	SR. No.	Schedule H1 drugs
1.	Alprazolam	**24.**	Doripenem
2.	Balofloxacin	**25.**	Diazepam.
3.	Buprenorphine	**26.**	Ertapenem
4.	Capreomycin	**27.**	Ethambutol Hydrochloride
5.	Cefdinir	**28.**	Zolpidem
6.	Cefditoren	**29.**	Ethionarnide
7.	Cefepime	**30.**	Feropenem
8.	Cefixime	**31.**	Imipenem
9.	Cefetamet	**32.**	Isoniazid
10.	Cefopeiazone	**33.**	Levofloxacin
11.	Cefotaxime	**34.**	Meropenem
12.	Cefpodoxime	**35.**	Midazolam
13.	Cefpirome	**36.**	Moxifloxacin
14.	Ceftazidime	**37.**	Nitrazepam
15.	Chlordiazepoxide	**38.**	Pentazocine
16.	Clofazimine	**39.**	Prulifloxacin
17.	Codeine	**40.**	Pyrazinamide
18.	Ceftibuten	**41.**	Rifabutin
19.	Ceftizoxime.	**42.**	Rifampicin
20.	Gemifloxacin	**43.**	Sodium Para-aminosalicylate
21.	Ceftriaxone	**44.**	Sparfloxacin
22.	Cycloserine	**45.**	Thiacetazone
23.	Diphenoxylate	**46.**	Tramadol

Note.- Preparations containing the above drug substances and their salts excluding those intended for topical or enernal use (except ophthatmic and ear or nose preparations) containing above substances are also covered by this Schedule.

NDPS drugs (Narcotic Drugs and Psychotropic Substances)

The central acts like Opium Act 1857, the opium Act, 1878 & the Dangerous Drugs Act, 1930 were erected a long time age.

- With the changing circumstances and the developments in the field illicit drugs traffic and drugs abuse at national and International level many drawbacks have come to notice in the said Acts.
- The government of India has repealed these old Acts passed the:
- These Acts established in 14 November 1985.
- It also provides the licensing system for both central & state government.

Cannabis:

1. Charas: Separated resin in crude or purified form obtained from the cannabis plant and raisin called ***"Hashish oil"***.
1. Ganja: The flowering or fruiting tops of the cannabis plants.
2. Caca Derivative: Includes crude cocaine which is a methyl ester of benzoyl-ecogonine and its salts.
3. Opium: Means the coagulated juice of the opium poppy and its mixture with or without neutral material.

Effects of drugs

When abused, drugs produce a variety of effects depending upon the drug:

- **Stimulants** increase the activity of the abuser and make him more lively and active. Some stimulants such as amphetamines were used in wars to make the soldiers more active.
- **Sedatives** make the person feel sleepy and reduce his activity. Opium and opiates are good examples of sedatives.
- **Hallucinogens** create hallucinations in the abuser. LSD is one of the well known hallucinogens.
- **Tranquilisers** calm the nerves of the addict without making him feel sleepy.

S.N.	Drug Lists of NDPS drugs
1.	Amphetamine
2.	Buprenorphine
3.	Charas/Hashish
4.	Cocaine
5.	Codeine
6.	Diazepam
7.	Ganja
8.	Heroin
9.	MDMA
10.	Methamphetamine
11.	Methaqualone
12.	Morphine
13	Poppy straw

Reserved Antibiotics

The reserved antibiotics are those antibiotics which are reserved for the treatment of suspected or diagnosed infection caused by multi -resistant organism , and they are used when all other antibiotics have failed .

1. Aztreonam	**2. Oritavancin**
3. Carumonam	4. Polymyxin B (Injection)
5. Colistin (Oral)	6. Tedizolid
7. Ceftaroline	8. Daptomycin
9. Cefiderocol	10. Faropenem
11. Ceftobiprole	12. Iclaprim
13. Ceftazidime + Avibactam	14. lefamulin
15. Ceftolozane + Tazobactam	16. Meropenem + Vaborbactam
17. Colistin (Injection)	18. Omadacycline
19. Dalbavancin	20. Plazomicin
21. Dalfopristin + Quinupristin	22. Polymyxin B (Oral)
23. Eravacycline	24. Telavancin
25. Fosfomycin (Injection)	
26. Imipenem + Cilastatin + Relebactam	
27. linezolid	
28. Minocycline (Injection)	

Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Procedures of Drug Purchases

- **Drug Purchase** means to obtain or get different types of medicines from external network.
- Pharmacies purchase drugs from wholesalers, and occasionally directly from manufacturers. After purchasing these drugs, pharmacies must safely store and dispense these drugs to patients.

Procedure for purchase

1) Purchase request form / Purchase requisition:

a) The pharmacist prepares the drug list to be buy and fills purchase request form .
b) This form provides information regarding required drugs , their quality and quantity .
c) This form will be sent to administration for approval , after approval it will sent to purchasing officer.

2) Quotation Invitation:

- Now the Purchasing officer send this form to different suppliers and ask their quotations

3) Purchase form:

- The purchasing officer checks all the quotations and select suppliers on the price, quality etc. and place the purchase orders.

4) Receipt of good products:

- When the ordered products delivered to the purchasing department, their quality, quantity and prices are checked. If the any products miss the desired quality, quantity, or price they should retuned to supplier.

5) Payment:

- After satisfactory completion all these process, the purchasing officer pay the amount to the suppliers.

Tender /e-tender

- It is a process in which a person or organization, who need goods / services etc. invites the other parties to submit a proposal to provide to provide their goods or services.

E-tender:

If this process is done by electronic machinery without using paper then it called E-tender.

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Unit-3

- Expiry drug removal and their disposal methods e.g., Narcotics
- Documentation - purchase and inventory.

Inventory Control techniques:-

The procedure of handling inventory of medicines, drugs so as to fulfill the demand of the customers at comparatively lower prices and with less amount of investment is called Inventory control.

Objectives of Inventory Control:-

1) It assures adequate supply of medical goods to customers and minimums the changes of shortages in a drug Store.
2) It helps in maintaining proper records in the drugs Store.
3) It helps in short-term and long-term planning for the production of medical product.
4) It also optimizes the amount of capital tied up in inventory of a drug store.
5) Inventory control helps in bringing efficiency in purchasing, storing, accounting for medical products.

Importance of Inventory Control:-

1) Better Service to Customers
2) Continuity of Production Operations
3) Reduces the risk of loss
4) Protects variation in Output
5) Proper Utilisation of working capital
6) Check on loss of material

Modern Techniques of Inventory Control

ABC Analysis:- The system of evaluating the drugs that are present in the storage on their cost price is called as ABC Analysis.

They are classified into three groups

1) Category A
2) Category B
3) Category C

Category *A* of the ABC Analysis Carries maximum amount of the total stock of drugs.

- The drug store wants to take benefits from these drugs in terms of money then they need to manage these drugs properly.

- The calculation of annual expenditure is done by multiplying the annual consumption from its unit cost in ABC analysis. The cumulative cost of drugs was calculated by organising the Annual Drug Expenditure (ADE) in the descending order according to the value of money.
- They need to manage those drugs properly . To reduce the cost of acquiring, storing and issuing of drugs right supervision is required.

Category B comparatively less supervision is required and the orders are required to be placed semi-annually.

Category C are drugs bought in large quantity and therefore its control is leveraged.

Advantage of ABC Analysis

1. Label of Control
2. Careful Accounting
3. Safety Stocks
4. Quantity discount Factor
5. Layout of stores.

Disadvantage of ABC Analysis

1. In big industries there are large number of drugs so the recording and calculations become very difficult.
2. Increase stock of drugs of category C may lead to deterioration and obsolescence.
3. Modification in some items falling in category B drugs could be very important.

VED Analysis :-

- This analysis depends on the crucial values and the shortage cost of drugs.

VED Are classified in three groups.

1. Vital (V) :- The vital category contains drugs that are necessary for the life of the patient and needs to be present all the time in the hospital. These Drugs it will hamper the daily working of the drug store.

2. Essential (E) :- The essential category contains medicine which are comparatively less crucial and kept in the hospital under this group. The categorisation of these drugs is done according to the urgency of the stock.

3. **Desirable (D) :-** The Desirable category contains medicine which are not crucial and are kept in the hospital under this category.

The shortage of these drugs dose not cause any harm to the life of the patient.

Lead Time:-

- The average time period between the placing of order of medicines and receipt of medicines is called Lead Time.
- It is considered when the other of the medicines is to be made.
- It helps in identifying the amount of medicines to be ordered in time so that there is no scarcity of medicines in the hospital.

Inventory Carrying Cost:-

- Carrying cost refers to the cost which is incurred due to storing of drugs in an inventory.
- It is also popular by the name of holding cost.
- The elements of carrying cost include the following.
- The opportunity cost of capital invested in the stock.
- The obsolescence cost includes scrapping and possible rework.
- The determination cost and costs incurred in preventing deteriorations.

Safety Stocks or Buffer Stock:-

- Safety stock, also referred to as buffer stock, is the excess inventory that a company carries to make sure they don't run out of stock on something.
- You can think of this like just in case inventory. It's extra merchandise stored just in case they run out of the items on the shelves.

Minimum and Maximum stock levels:-

- Minimum and maximum stock levels are stock limits for the customer location product that the customer agrees upon with the supplier. The projected stock must not fall below the minimum stock level. For more information, see Calculation of Projected Stock.
- The maximum stock level is the maximum quantity of stock that is to be on hand at the customer. You can use different methods to determine these stock parameters.

Economic order quantity:-

- Ordering costs and carrying cost of drugs are taken into consideration while determining economics order quantity of a Drug store.
- Ordering costs is basically the cost associated with receiving an inventory while carrying costs includes handling warehousing and allied cost.

Scarp and surplus disposal

The residue attained in the manufacturing process is called scrap. These are the items whose value can be recovered but in a very less amount without being processed further.

Example- granules that are found in the manufacturing of tablet packing cases and containers that is not to be returned

Re-Order Level (ROL)

- Re-Order Level (ROL) implies the material level at which purchase requisition is generated for a fresh supply of material.
- When the stock on hand, approaches the reorder point, the storekeeper takes action to replenish the exhausted stock. So, the difference between reorder level and minimum level will be adequate to meet the production requirement till the fresh supply is received.
- Re-Order Quantity (ROQ) represents the size of the order, which is going to be placed by the entity with the selected supplier when the stock level touches reorder level.

Definition:

- If the firm has an idea about the lead time, EOQ, and consumption pattern, Reorder level can be determined easily.

Formula for Re-Order Level

In general, Re-Order Level is calculated using the following formula:

- **Re-order Level = Maximum Consumption × Maximum Reorder Period**

Further, if the maximum consumption is not known, Re-Order Level can also be calculated using an alternative formula:

- **Re-order Level = Minimum Stock Level + (Average Rate of Consumption × Average Reorder Period)**

If the company maintains safety stock it can be calculated as:

- **Re-Order Level = Safety Stock + (Average Consumption per day × Average Lead Time)**

Reorder Quantity Level:

- The reorder stock level is the level of inventory at which a new purchase order should be placed.
- The reorder level of stock is the fixed stock level that lies between the maximum and minimum stock levels. At the reorder stock level, an order for the replenishment of stock should be placed.
- The reorder level of stock is generally higher than the minimum level to cover any emergencies that may arise as a result of abnormal usage of materials or unexpected delay in obtaining fresh supplies.

Formula for Reorder Level of Stock

The reorder level of stock is calculated using the following formula:

- Reorder level of stock = Maximum consumption per day/per week etc. x Maximum delivery time

Another formula that can be used is:

- Reorder level of stock = Minimum stock + Average consumption during normal delivery time.

Choosing which formula to use depends on the information you are given in a problem.

When calculating the reorder level of stock, it is worth noting that it is revised periodically by considering the factors that are likely to change supply and demand for goods.

Inventory Turnover

- The inventory turnover ratio measures how fast the company replaces a current batch of inventories and transforms them into sales. A higher ratio indicates that the company's product is in high demand and sells quickly, resulting in lower inventory management costs and more earnings.
- The inventory turnover is a measure of the number of times inventory is sold or used in a time period such as a year.
- It is calculated to see if a business has an excessive inventory in comparison to its sales level.
- The equation for inventory turnover equals the cost of goods sold divided by the average inventory. Inventory turnover is also known as inventory turns, merchandise turnover, stockturn, stock turns, turns, and stock turnover.

Inventory Turnover Ratio Formula

$$\textbf{Inventory Turnover Ratio} = \frac{\textbf{Cost of Goods Sold}}{\textbf{Average Inventory}}$$

Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods

Inventory Management of Central Drug Store:

Drug store management is based on principles of inventory control. Mis-management of stores and non-applicability of Scientific and Modern techniques has been identified as the root cause of material storage in majority of hospitals.

Objective of Inventory Control

(i) To supply drug in time.
(ii) To reduce investment in inventories and made effective use of capital investment.
(iii) Efforts are made to procure goods at minimum price without bargaining the quality.
(iv) To avoid stock out and shortage.
(v) Wastage are avoided

Techniques of Inventory Management:

Intuitive Method: This is the most common method in practice today and surely the least effective. Items are recorded in the want book when the number of units in stock reaches one to three, and the amount ordered is the best estimate of the person in charge of inventory.

Storage conditions

Cold storage: 2-8^{o}C

Cool temp: 8-25 ^{0}C

Room temp RT-temp. Temperature prevailing in working area.

Warm: 30-40^{o}C

Excessive Heat: Above 40^{o}C

Methods of storage

Bulk packaging

- The majority of medications in outpatient pharmacies are received in bulk stock bottles. These bottles include labeling that is required by the FDA: brand and generic drug names, dosage form, quantity, national drug code (NDC) number, lot number, expiration date, name of the manufacturer, and storage requirements.

Unit dose packaging

- In hospitals or inpatient pharmacies, medications are often packaged individually for ease of use by the nursing staff and to decrease contamination of unused medication by sick patients.
- Unit dose packaging must be labeled properly and must include the generic name and strength of the medication, dosage form, the name of the manufacturer, expiration date, and lot number.
- Medications sent from the wholesaler in unit dose packaging generally have the required information on the packaging already, but the pharmacy technician should be aware of these requirements.

Repackaging medications

- The machines can range from simple manual machines that separate the medication into each blister package, all the way to automatic machines that can fill each package as well as create labels with all required information for each unit dose.

General drug storage

The manufacturer's recommendations should be followed when storing prescription medications.

Many medications are able to be stored at room temperature, between 59-86 degrees F. Drugs should not be stored above or below this temperature range unless authorized by the manufacturer.

The storage area should be clean and free of clutter, moisture, and dust, and be properly ventilated to allow for adequate airflow around the products.

Distribution of Drugs to Wards-

- Drugs should be supplied in the original packing of manufacturers. However if it is not possible to do so, then that should be supplied in clean containers so that the integrity and original properties can be preserved.
- Name and quantity of the drug should be properly labelled.
- It is always advisable that suitable precautions should be taken to dispose off "Original empty containers" in order to avoid their misuse.
- The containers should be destroyed in the presence of a responsible person with a written statement signed by him.
- Chief pharmacist should visit wards to check whether the drugs are properly stored under special storage conditions like cold storage, cool temperature and at room temperature.

Drug Distribution System

1) **Distribution of drugs to indoor patients** (Patients in wards, operation theatres, X-ray, and other specified departments)
2) **Distribution of drugs to outdoor patients** (Patients not admitted and not occupying bed)

Out-patient Services:-

- This type of patients is not admitted in hospital and is given general or emergency treatment which could be diagnosis, therapeutic, or preventive.
- An out-patient department keeps a check on patients who not to be admitted and require only diagnostic and therapeutic services.

There are three types of out-patients:-

1) General out-patient: such a patient is given treatment for a general condition or emergency condition but not referred case.

E.g. Diahorrea, Hypertension, Diabetes, Fever etc.

2) Referred Out-patient: In this type patient is referred to out-patient department by the attending medical/dental practitioner for specific treatment, and the patients for further treatment returns to the practitioner.

3) Emergency out-patient: In this type patient is given emergency or accident care for conditions (Determined clinically or considered by the patient or his representative) demanding instant medical attention.

In-patient services:-

The patient which is admitted in hospital receiving general or specific treatment is called In-patient.

Types of services provided to In-patients.

1) Individual prescription order system
2) Complete floor stock system
3) Combination of individual drug order and floor stock system
4) Unit dose dispensing system
5) Bed size pharmacy

Maintaining Cold chain

It means to provide 2-8 ° C temperature to any product like vaccines, during manufacturing, storing , transporting ,and distribution , to maintain their potency .

Devices Used for Cold Storage:

1) Refrigerator
2) Thermometer which indicate the temperature level.
3) Cold boxes for storage and transportation.
4) Ice packs

IRLs (ice lined refrigerator)

- Ice lined refrigerator is a type of refrigerator which has an extra function where cold ice water , or ice packs are filled . they maintain the inside temperature at a safe level in case of electricity fails .

Walk In Cold Rooms (WIC)

- Walk- in cold room is a cold storage condition on a large scale and it provide a constant an comfortable temperature throughout the space .

FIFO and FEFO

FIFO: Means First In, First Out It is a method in which the product came first in the warehouse in taken out first, to avoid expiration.

FEFO: It means First Expire, First Out. In this method the products whose expiry is closest are out first, to avoid expiration.

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- **Documentation - purchase and inventory.**

Expiry

- There is a time period and condition in which a drug is good for use, and ending this time period or missing the specific condition (temperature, darkness) in which a drug is good, called Expiry .
- Expired drugs imply financial losses because they should no longer be distributed and must be discarded.

Removal and Handling of expired Drugs

- It is a process of store management to remove the expired drugs from store and to handle properly so that they should not be given to use.

Disposal of Expiry Drugs

- Disposal of expiry drugs means destroying the expired drugs so they cannot use.
- Disposal methods recommended by the International Authorities

Following actions can be taken for handling expired drugs

1. Return to donor or manufacturer
2. Waste immobilization: encapsulation.
3. Landfill
4. Waste immobilization: encapsulation
5. Waste immobilization: inertization.
6. Sewer
7. Burning in open containers
8. Chemical decomposition

1) Returning to the Manufacturing: The Manufacturer has good disposal method at its disposal.

2) Landfill: This is the oldest and best way for disposal of solid waste, In this method the waste materials are placed into land.

- The municipal waste should be used to cover this site.

3) Waste immobilization (Encapsulation): In this method, the pharmaceuticals are packed in a plastic or steel drum , solid and semi solid materials are filled 75 % of drum, then mixture of lime, cement and water in 15: 15: 5 ratio is filled, then mouth of drum sealed and placed in landfill and cover with municipal solid waste.

4) Sewer: Syrups and IV fluids are diluted with water and flushed into sewer, in small quantity, over a time period.

5) Incineration: In this methods the waste material are given high temperature heat to be destroyed.

6) Chemical Disposal: In this chemicals are used to destroy the expired drugs.

Disposal Of Narcotics

- Narcotics drugs should be disposed in supervision of a pharmacist or the police, and public should not be allowed to prevent abuse .

Documentation of purchase and Inventory

- Documentation means to write every purchase, inventory retuned products .

Inventory Control

- Inventory Control is designed to support the requisition processing, inventory management, purchasing, and physical inventory reconciliation functions of inventory management through a set of highly interactive capabilities.
- **The design of Inventory Control is based on the following….**
  - To facilitate timely requisition processing
  - To automatically record and service backorders
  - To help minimize inventory investments consistent with service objectives by basing purchasing decisions on usage history
  - To provide automated tools to assist servicing, purchasing, and management of the inventory
  - To improve financial control of the inventory by chargebacks to the user organizations
  - To improve financial control of the inventory by periodic reconciliation of the inventory balances with the physical counts.

Documents for Inventory Control:

Inventory Control includes the following documents

- Stock Requisition (SR)
- Pick and Issue (PI)
- Issue Confirmation (CI)
- Over the Counter (OC)
- Stock Return (SN)
- Inventory Adjustment (IA)
- Physical Inventory Purchase Input (IP)
- Stock Transfer Issue (TI)

Stock Requisition (SR)

- Reserves quantities of stock items from an on-hand supply for later delivery.
- This reduces the available quantity.
- If items are not immediately available, they may be backordered and later filled by having the Backorder Servicing program run.

Pick and Issue (PI)

- Schedules previously reserved items to be picked up for delivery and releases them from a reserved status. This function is performed by creating a Pick Ticket Report (IN80).
- From this report, the warehouse can determine the stock item, the quantity, and the bin number of the items that are to be picked up.
- It also creates the corresponding Issue Confirmation (CI) document.

Stock Issue Confirmation (CI)

- Confirms to the system that previously reserved and released items have been issued from the warehouse to the buyer.
- The on-hand quantity of the warehouse for this item is reduced by the amount issued.

Over the Counter (OC)

- Issues requested items directly from the on-hand quantity. As the items are issued immediately upon request, in effect, "over-the-counter," backordering is not allowed.
- Once an "Over the Counter" transaction is successfully completed, an Over the Counter Issued Report will be produced, identifying the requestor and the stock items issued.

Stock Return (SN)

- Allows the original buyer to return previously issued items. At the option of the issuing warehouse, a return charge may be imposed.

Inventory Adjustment (IA)

- Allows warehouse management to adjust quantities or unit values of on-hand items due to a change in on-hand quantities or unit costs.
- These adjustments alter inventory and cost of goods expense balances.

Physical Inventory Purchase Input (IP)

- Allows warehouse management to adjust quantities of on-hand items due to a change in on-hand quantities at a specified unit costs.
- These adjustments alter inventory and cost of goods expense balances.

Stock Transfer Issue (TI)

- Initiates the transfer of items from one warehouse to another.

Stock Transfer Receipt (TR)

- Recognizes the receipt of transfer items by the receiving warehouse. On-hand quantities of receiving/issuing warehouses are adjusted.